EXHIBIT 16

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

JDS UNIPHASE CORPORATION
Petitioner

v.

CAPELLA PHOTONICS, INC.
Patent Owner

Patent No. RE42,368
Filing Date: June 15, 2010
Reissue Date: May 17, 2011

Title: RECONFIGURABLE OPTICAL ADD-DROP MULTIPLEXERS WITH SERVO CONTROL AND DYNAMIC SPECTRAL POWER MANAGEMENT CAPABILITIES

Inter Partes Review No. Unassigned

PETITION FOR *INTER PARTES* REVIEW UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 ET SEQ.

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Exhibit 1020: Andrew S. Dewa, and John W. Orcutt, *Development of a silicon 2-axis micro-mirror for optical cross-connect*, Technical Digest of the Solid State Sensor and Actuator Workshop, Hilton Head Island, SC, June 4-8, 2000) at pp. 93-96 ("Dewa")

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Exhibit 1031: U.S. Patent No. 5,414,540 to Patel et al. ("Patel")

Exhibit 1032: Borella, et al., Optical Components for WDM Lightwave Networks, Proceedings of the IEEE, Vol. 85, NO. 8, August 1997 ("Borella")

Exhibit 1033: U.S. Patent No. 6,928,244 to Goldstein et al. ("Goldstein '244")

Exhibit 1034: Steffen Kurth et al., Silicon mirrors and Micromirror Arrays for Spatial Laser Beam Modulation, Sensors and Actuators, A 66, July 1998

Exhibit 1035: C. Randy Giles and Magaly Spector, *The Wavelength Add/Drop Multiplexer for Lightwave Communication Networks*, Bell Labs Technical Journal, (Jan.-Mar. 1999) ("Giles and Spector")

Exhibit 1036: U.S. Patent No. 5,872,880 to Maynard (the "Maynard patent")

I. INTRODUCTION

Petitioner JDS Uniphase Corporation requests *inter partes* review under 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42, of claims 1-6, 9-13, and 15-22 (the "Petitioned Claims") of U.S. Patent No. RE42,368 (Ex. 1001) ("the '368 Patent"), assigned on its face to Capella Photonics, Inc (the "Patent Owner").

In prosecuting its reissue patent, patentee acknowledged that its original claim set was overbroad and invalid in light of U.S. Patent No. 6,498,872 (Ex. 1003) ("Bouevitch"). To fix this mistake and to distinguish over Bouevitch, patentee made two amendments to all of its independent claims. But those amendments merely swapped one known component for another known component. As described in the body of this petition, those amendments swapped one known type of mirror for another known type of mirror.

While the patentee's reissue amendments may have minimally addressed the novelty issues in light of Bouevitch, those amendments do not overcome obviousness. Bouevitch in combination with the prior art described in the body of this petition renders the Petitioned Claims invalid as obvious.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(A)(1)

A. Real Party-In-Interest under 37 C.F.R. § 42.8(b)(1)

Petitioner JDS Uniphase Corporation is the real party-in-interest for this petition.

B. Related Matters under 37 C.F.R. § 42.8(b)(2)

The '368 Patent is asserted against third party Cisco Systems, Inc. in an on-going patent lawsuit brought by Patent Owner in *Capella Photonics, Inc. v. Cisco Systems, Inc.*, Civil Action Nos. 1-14-cv-20529 ("Capella litigation"), filed in the Southern District of Florida on February 14, 2014. Claims 1-6, 9-13 and 15-22 of the '368 Patent are asserted in the Capella litigation.

The '368 Patent is also the subject of an *inter partes* review proceeding, IPR2014-01166. *Inter partes* review of claims 1-6, 9-13 and 15-22 in that case was ordered on January 30, 2015. The contentions of the present Petition regarding obviousness of claims 1-6, 9-13 and 15-22 share some similarities, but are not identical, to those of IPR2014-01166. For example, IPR2014-01166 uses U.S. Patent No. 6,798,941 to Smith ("Smith") as a secondary reference under §103(a) while the present Petition does not rely on Smith and instead uses U.S. Patent No. 6,625,340 to Sparks ("Sparks"). Both Smith and Sparks qualify as §102(e) prior art with respect to the '368 Patent. However, Sparks has an earlier priority date relative to Smith and therefore Sparks has a higher likelihood of surviving a prior-invention date challenge. Also, Sparks and Smith are not identical. For at least these reasons, the present Petition and underlying contentions are not redundant in view of IPR2014-01166.

Petitioner is also filing a petition for *inter partes* review of U.S. Patent

RE42,678 which is directed to subject matter similar to that of the '368 Patent.

C. Lead and Back-Up Counsel under 37 C.F.R. § 42.8(b)(3)

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Petitioners hereby request authorization to file a motion for Kenneth Liebman to appear pro hac vice. Mr. Liebman is an experienced litigation attorney and has established familiarity with the subject matter at issue in the proceeding. Petitioners will file such motion upon the grant of this request.

D. Service Information

As identified in the attached Certificate of Service, a copy of the present petition, including all Exhibits and a power of attorney, is being served on the attorney or agent of record for the '368 Patent.

Petitioner's lead and back-up counsel may be served at the address provided

in Section I.C. of this Petition. Petitioner consents to service by e-mail at the e-mail addresses of lead and back-up counsel provided above.

E. Power of Attorney

A power of attorney is being filed concurrently with this petition in accordance with 37 C.F.R, § 42.10(b).

III. PAYMENT OF FEES - 37 C.F.R. § 42.103

This petition for *inter partes* review requests review of 19 claims of the '368 Patent and is accompanied by a request fee payment of $24,600. *See* 37 C.F.R. § 42.15. Thus, this petition meets the fee requirements under 35 U.S.C. § 312(a)(1).

IV. REQUIREMENTS FOR *INTER PARTES* REVIEW UNDER 37 C.F.R. § 42.104

A. Grounds for Standing under 37 C.F.R. § 42.104(a)

Petitioner certifies that the '368 Patent is eligible for *inter partes* review and further certifies that Petitioner is not barred or otherwise estopped from requesting *inter partes* review challenging the identified claims on the grounds identified within the present petition.

B. Identification of Challenge under 37 C.F.R. § 42.104(b) and Statement of Precise Relief Requested

Petitioner requests *inter partes* review of claims 1-6, 9-13, and 15-22 of the '368 Patent under the statutory grounds set forth in the table below. Petitioner asks that each of the claims be found unpatentable. An explanation of how the Petitioned Claims are unpatentable is included in Part VIII of this petition.

Additional explanation and support for each ground is set forth in the Declaration of a technical expert, Sheldon McLaughlin, Ex. 1028 ("McLaughlin Decl.").

Ground	'368 Patent Claims	Basis for Challenge
1	1-6, 9-13, and 15-22	Obvious under § 103(a) by Bouevitch in view of Sparks.
2	1-6, 9-13, and 15-22	Obvious under § 103(a) by Bouevitch in view of Sparks further in view of Lin.
3	12	Obvious under § 103(a) by Bouevitch in view of Sparks in further view of Dueck.
4	12	Obvious under § 103(a) by Bouevitch in view of Sparks and Lin in further view of Dueck.

Each of the references relied upon in the grounds set forth above qualify as prior art under 35 U.S.C., § 102(e) or (b).

This Petition and the Declaration of Sheldon McLaughlin, submitted herewith, cite additional prior art materials to provide background of the relevant technology and to explain why one of skill in the art would combine the cited references.

C. Threshold Requirement for *Inter Partes* Review 37 C.F.R. § 42.108(c)

Inter partes review of claims 1-6, 9-13, and 15-22 should be instituted

because this Petition establishes a reasonable likelihood that Petitioner will prevail with respect to at least one of the claims challenged. (*See* 35 U.S.C. § 314(a).) Each limitation of the challenged claims is disclosed by and/or obvious in light of the prior art.

V. BACKGROUND OF TECHNOLOGY RELATED TO THE '368 Patent

Fiber-optic communication uses light to carry information over optical fibers. Originally, fiber-optic systems used one data channel per fiber. To increase the number of channels carried by a single fiber, wavelength division multiplexing ("WDM") was developed. WDM is a type of optical communication that uses different wavelengths of light to carry different channels of data. WDM combines (multiplexes) multiple individual channels onto a single fiber of an optical network. WDM was known before the '368 Patent's priority date. (E.g., Ford, Ex. 1015 at 904.)

At different points in a fiber network, some of the individual channels may be extracted (dropped) from the fiber, for example when those channels are directed locally and need not be passed further down the fiber network. And at these network points, other channels may also be added into the fiber for transmission onward to other portions of the network. To handle this add/drop process, optical add-drop multiplexers (OADMs) were developed. OADMs are used to insert channels onto, pass along, and drop channels from an optical fiber

without disrupting the overall traffic flow on the fiber. ('368 Patent, Ex. 1001 at 1:51-58.) OADMs were known long before the '368 Patent's priority date. (E.g., Ford, Ex. 1015 at 904.)

(Re)configurable OADMs are referred to as "ROADMs" or "COADMs," which are controllable to dynamically select which wavelengths to add, drop, or pass through. (Bouevitch, Ex. 1003 at Abstract; Ex. 1019 at 64.) These types of devices were known in the art prior to the '368 Patent's priority date. (McLaughlin Decl., Ex. 1028 at ¶ 21.)

ROADMs operate by separating the input light beam into individual beams—each beam corresponding to an individual channel. Each input channel/beam is individually routed by a beam-steering system to a chosen output port of the ROADM. For example, a first channel can be steered so that it is switched from an "input" port to an "output" port. Channels switched to the "output" port are passed along the network. At the same time, a second channel can be switched to a "drop" port and removed from the main fiber. The ROADM could also add a new channel to the main fiber through the "add" port to replace the dropped channel. These add/drop techniques were known prior to the '368 Patent's priority date. (McLaughlin Decl., Ex. 1028 at ¶ 29; Bouevitch, Ex. 1003 at 5:15-38; Ex. 1016 at 1:55-2:45; Ex. 1017 at 1:56-67.)

In addition to routing channels, ROADMS may also be used to control the power of the individual channels. Power control is often performed by steering individual beams slightly away from the target port such that the misalignment reduces the amount of the channel's power that enters the port. This misalignment power control technique in ROADMs was known prior to the '368 priority date. (*See e.g.*, McLaughlin Decl., Ex. 1028 ¶ 26, ¶ 50; Bishop, Ex. 1006 at 2:9-21.)

ROADMs use wavelength selective routers (WSRs) to perform switching and power control. (Kewitsch, Ex. 1026 at 10:64-11:29.) WSRs are also referred to as wavelength selective switches (WSSs). (*See*, *e.g.*, Ranalli, Ex. 1027 at Fig. 1.) As of the '368 priority date, WSRs/WSSs were known. (*See, e.g.*, McLaughlin Decl. Ex. 1028 at ¶ 26; Kewitsch, Ex. 1026 at Abstract, 4:15-25; Ranalli, Ex. 1027 at Fig. 1; Borella, Ex. 1032 at 1292.)

The embodiment of WSRs relevant to this petition steers light beams using small tilting mirrors, sometimes called MEMS, which stand for Micro ElectroMechanical Systems. (McLaughlin Decl., Ex. 1028 ¶ 27, 22.) Prior-art WSRs could tilt the individual mirrors using analog voltage control. (*Id.*) The tilt allows reflected beams to be aimed at selected ports. Prior-art MEMS mirrors could be tilted in one or two axes. (*Id.* at ¶28.)

VI. SUMMARY OF THE '368 Patent

The '368 Patent originally issued as U.S. Patent No. 6,879,750. According to the patentee, the original patent's claims were invalid over Bouevitch. The patentee expressly acknowledged its claiming mistake and identified the two elements that it alleged needed to be added to its claims to support patentability– (1) mirror control in two-dimensions, and (2) the power control via mirror tilt:

> ***At least one error upon which reissue is based is*** **described as follows:** ***Claim 1 is deemed to be too broad and invalid in view of U.S. Patent No. 6,498,872 to Bouevitch*** and further in view of one or more of Ex. 1023 U.S. Patent No. 6,567,574 to Ma, Ex. 1024 U.S. Patent No. 6,256,430 to Jin, or Ex. 1025 U.S. Patent No. 6,631,222 to Wagener ***by failing to include limitations regarding the spatial array of beam deflecting elements being individually and continuously controllable in two dimensions to control the power of the spectral channels*** reflected to selected output ports, as indicated by the amendments to Claim 1 in the Preliminary Amendment. (Ex. 1002 at 81-82.)

In its efforts to distinguish over Bouevitch, patentee's first amendment specified that the beam-deflecting elements must be controllable in two dimensions. This amendment corresponds to a mirror tilting in two axes rather than one. As for the second amendment, Patent Owner added a use clause stating that the beam-deflecting elements was intended to be used for power control of a spectral channel. As explained in the claim construction section (§ VII, below), this

clause is merely functional language and is limiting only to those structures that may be capable of performing spectral channel power control. Claim 1 of the '750 patent as amended, with the amendments underlined, is shown in Table 1.

Table 1	
1	An optical add-drop apparatus comprising
1a	an input port for an input multi-wavelength optical signal having first spectral channels;
1b	one or more other ports for second spectral channels; an output port for an output multi-wavelength optical signal;
1c	a wavelength-selective device for spatially separating said spectral channels;
1d	a spatial array of beam-deflecting elements positioned such that each element receives a corresponding one of said spectral channels, each of said elements being individually and continuously controllable <u>in two dimensions</u> to reflect its corresponding spectral channel to a selected one of said ports <u>and to control the power of the spectral channel reflected to said selected port.</u>

The patentee made almost identical amendments to the 3 other independent claims. Through the patentee's admissions about Bouevitch, the patentee also admitted that Bouevitch disclosed all the elements of at least claim 1, except for 2-axis mirrors. The patentee first admitted that Bouevitch anticipated the pre-reissue version of claim 1 as it appeared in the '750 patent. Following that, the only

amendments the patentee added to the claim were 2-axis mirrors and their intended use for power control. Because the intended use language limits the claims to capable structures, the patentee admitted that Bouevitch disclosed all limitations but for 2-axis mirrors capable of power control. (*See* MPEP § 2217 ("admissions by the patent owner in the record as to matters affecting patentability may be utilized during a reexamination") (citing 37 CFR 1.104(c)(3)).)

VII. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)

A. Legal Overview

A claim subject to *inter partes* review ("IPR") is given its "broadest reasonable construction in light of the specification of the patent in which it appears." (37 C.F.R. § 42.100(b).) Except as expressly set out below, Petitioner construes the language of the claims to have their plain and ordinary meaning. Petitioner notes that the standard of construction applied in this proceeding is not necessarily that which would be applied in any related litigation, and, as such, reserves the right to proffer other claim construction positions in litigation in conformity with any applicable and relevant standards therein.

B. "continuously controllable"

The term "continuously controllable" is recited in claims 1, 15, and 16. The broadest reasonable interpretation ("BRI") for the term "continuously controllable" in light of the specification is "able to effect changes with fine precision".

It is noted that the '368 Patent provided "under analog control" as an example of continuous control. The '368 Patent explains that "[a] distinct feature of the channel micromirrors in the present invention, in contrast to those used in the prior art, is that the motion...of each channel micromirror is under ***analog control*** such that its pivoting angle can be ***continuously adjusted***." (*Id.*, 4:7-11; emphasis added). Another passage in the specification states that "[w]hat is important is that the pivoting (or rotational) motion of each channel micromirror be individually ***controllable in an analog manner, whereby the pivoting angle can be continuously adjusted*** so as to enable the channel micromirror to scan a spectral channel across all possible output ports." (*Id.*, 9:9-14; emphasis added). Yet another passage states that "channel micromirrors 103 are individually controllable and movable, e.g., pivotable (or rotatable) under analog (or continuous) control." (*Id.*, 7:6-8). While an element that is under analog control would therefore be within the scope of the BRI of continuously controllable, the example of analog control does not alone define the BRI of continuously controllable.

C. "in two dimensions"

The term "in two dimensions" is recited in claims 1, 15, and 16. The BRI for this term in light of the specification is "in two axes." As the claim states, the "beam-deflecting elements" are controllable "in two dimensions." The '368 Patent consistently describes these beam-deflecting elements as various types of mirrors

which are rotated around the two axes in which the mirrors tilt to deflect light. The specification states, for example, that the beam-deflecting elements "may be pivoted about one or two axes." (Ex. 1001 at 4:25-26, Abstract.) The specification also describes certain embodiments that use two-dimensional arrays of input and output ports. For these embodiments, the specification describes that the mirrors are required to tilt along two axes ("biaxially") to switch the beams between the ports. (*Id.*, 4:25-29.) And further, the '368 Patent explains how to control power by tilting the mirrors in two axes. (*Id.*, 16:36-51 (describing the combined use of major and minor "tilt axes" for power control & switching).)

D. "to control the power of the spectral channel reflected to said selected port"

The term "to control the power of the spectral channel reflected to said selected port" is recited in claims 1, 15, and 16. The BRI for this term in light of the specification is "to change the power in the spectral channel that is received by a particular port". It is noted that the claim language refers merely to intended use, and thus is limited only to structure that may be capable of redirecting a spectral channel to a particular port.

E. "**spectral monitor**"

The term "spectral monitor" is recited in claim 3. The BRI for the term "spectral monitor" is "a device for measuring power in a spectral channel." This definition is consistent with the use of the term in the specification, where the

monitor is used to measure the power of the output signals. The spectral monitor is shown in Figure 4A measuring output power, and the specification describes the spectral monitor as providing power measurement of a spectral channel as part of a feedback loop. (*See* '368 Patent, Ex. 1001 at 11:14-23 ("processing unit 470 uses the power measurements from the spectral monitor 460 to provide feedback control").) Measuring the power of individual channels of a multiplexed or de-multiplexed signal is within the scope of the BRI of spectral monitor.

F. "servo-control assembly"

The term "servo-control assembly" is recited in claims 3 and 4. The BRI for the term "servo control assembly" in light of the specification is "feedback-based control assembly". This definition is consistent with the use of the term in the specification, which equates servo control with use of a feedback loop. For example, when describing its "servo control," the '368 Patent teaches a spectral monitor that provides "feedback" control for the mirrors. "The servo-control assembly 440 further includes a processing unit 470, in communication with the spectral monitor 460 and the channel micromirrors 430 of the WSR apparatus 410. The processing unit 470 uses the power measurements from the spectral monitor 460 ***to provide feedback control*** of the channel micromirrors 430." (*Id.*, 11:18-24 emphasis added.) In another passage, the '368 Patent states that the servo-control assembly "serves to monitor the power levels of the spectral channels coupled into

the output ports and further provide control of the channel micro mirrors on an individual basis, so as to maintain a predetermined coupling efficiency of each spectral channel." (*Id.*, 4:45-52.)

Moreover, in the figure that the `368 Patent labels "servo-control assembly," the '368 Patent shows a controller which takes measurements of the output power and moves the mirrors to further adjust that power—a typical feedback loop. (*Id.*, Fig. 4a; Ex. 1014.) Also confirming this BRI, the feedback-based control described in the '368 Patent achieves the same goals that the patent ascribes to its "servo-control assembly"—dynamic adjustment to account for changing conditions, such as the possible changes in alignment of the parts within the device. (Ex. 1001 at 4:56-67.)

Petitioner is aware that a "servo" can sometimes refer to a servomotor, which is a type of actuator. But that is not what the patent is referring to here with its use of servo in the context of a "servo-control assembly." Should Patent Owner attempt to change the "servo-control assembly" to refer instead to some "servo"-based *actuation* mechanism (as opposed to a ***control*** mechanism), there is no support for that in the specification. The '368 Patent nowhere address the details of the MEMS mirror actuation, and instead discusses "servo-control" and "servo-based" strictly in terms of the ***control*** system used to move the mirrors, not the

actuation mechanism that physically moves them. (*See*, *e.g.*, *Id.* at 4:45-, 5:5, 6:3-16, 10:62-12:49.)

G. "beam-focuser"

The term "beam-focuser" is recited in claim 11. The BRI for the term "beam-focuser" in light of the specification is "a device that directs a beam of light to a spot." This definition is consistent with the use of the term in the specification and the claims. The Summary of the '368 Patent states that the "beam-focuser focuses the spectral channels into corresponding spectral spots." (*Id.*, 3:63-64.) The specification also explains that the beams of light are "focused by the focusing lens 102 into a spatial array of distinct spectral spots (not shown in FIG. lA) in a one-to-one correspondence." (*Id.*, 6:65-7:5.) The MEMS mirrors are in turn "positioned in accordance with the spatial array formed by the spectral spots, such that each channel micromirror receives one of the spectral channels." (*Id.*) Claim 11 echoes this, saying that the beam focuser is "for focusing said separated spectral channels onto said beam deflecting elements."

Patent Owner may attempt to narrow "beam-focuser" to a particular one of the embodiments in the '368 Patent. For example, one embodiment of a "beam focuser" in the patent corresponds to element 103 in Fig. 3, which depicts a lens focusing light onto a MEMS mirror array. However, the specification also notes that the "focuser" has a broader meaning than simply a lens, and instead, "[t]he

beam-focuser may be a single lens, an assembly of lenses, or other beam-focusing means known in the art." (*Id.*, 4:20-22.) Thus, the BRI of "beam-focuser" covers any device capable of directing a beam of light to a spot.

H. "controlling dynamically and continuously"

The term "controlling dynamically and continuously" is recited in claim 17. This term is similar to the term "continuously controllable" addressed above (§ VII.B) while the term also includes the aspect of dynamic control. The word "dynamically" imports an aspect of control during operation. In view of the BRI for continuously controllable discussed above, the BRI for "controlling dynamically and continuously" is "able to effect changes with fine precision during operation".

I. "control the power of the spectral channels combined into said output multi-wavelength optical signal"

The term "control the power of the spectral channels combined into said output multi-wavelength optical signal" is recited in claim 17. The BRI for this term in light of the specification is "to change the power of one or more spectral channels of a set of spectral channels that are, at some point, routed along the same path". It is noted that the claim term does not limit where the power control occurs in relation to when or where the spectral channels are combined.

VIII. CLAIMS 1-6, 9-13, AND 15-22 OF THE '368 PATENT ARE UNPATENTABLE

The Petitioned Claims are obvious over Bouevitch in view of Sparks (for Ground 1), and also further in view of Lin (for Ground 2). Claim 12 is also obvious under Grounds 1 or 2 in further view of Dueck (Grounds 3 & 4). Petitioner provides below (1) an overview of the status of Bouevitch, Sparks, Lin and Dueck as prior art, (2) a general description of Bouevitch and Sparks, (3) motivations to combine these references; and (4) a description of how these references disclose each Petitioned Claim on an element-by-element basis.

A. Sparks, Lin and Dueck are all prior art to the '368 Patent

Bouevitch and Sparks both qualify as prior art under 35 U.S.C. § 102(e) (pre-AIA), because each reference is a patent that issued from an application filed in the United States prior to the earliest application to which the '368 Patent could claim priority. The earliest facial priority date for the '368 Patent is based on a provisional application filed on March 19, 2001.

Bouevitch is entitled to a 102(e) prior art date of at least its filing date of December 5, 2000 (and to the February 17, 2000 filing date of the corresponding provisional application). This date is before the earliest '368 priority date.

Sparks is entitled to a 102(e) prior art date as of its filing date, December 29, 1999, which is before the earliest '368 priority date. As noted in § II.B above, the priority date of Sparks, used as a secondary reference herein, is earlier than that of

the Smith reference that is used as a secondary reference in Case IPR2014-01166, and these challenge basis are not redundant in view of Smith.

Dueck is entitled to the 102(b) prior art date of its filing: Dec. 13, 1997. Dueck describes various diffraction gratings for use in WDM devices.

Lin is entitled to the 102(b) prior art date of its filing: Sept. 29, 1995. Lin describes a MEMS optical switch including continuous, analog, control of mirrors.

B. Overview of the Bouevitch Prior Art

Bouevitch explicitly discloses every element of the 4 independent claims of the ‘368 Patent (and most dependent claims) except for the use of mirrors rotatable in two axes. Bouevitch discloses mirrors that are rotatable in a single axis.

Bouevitch discloses a configurable optical add/drop multiplexer (COADM) that uses MEMS mirrors for routing signals and controlling power. (*Id.*, Abstract) By tilting its MEMS mirrors, the Bouevitch COADM switches an input spectral channel to either an output port or a drop port. (*Id.*, 14:14-15:18, Fig. 11.) The Bouevitch COADM can add a new channel in place of a dropped channel. (*Id.*)

The Bouevitch COADM controls the power of its output channels by tilting beam-deflecting elements (mirrors) at varying angles to control power. The “degree of [power] attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection).” (*Id.*, 7:23-37.) Bouevitch refers to this power control process as Dynamic Gain Equalizer (DGE) and discloses that the

DGE is used "to control the relative power levels in respective channels" of a WDM system. (*Id.*, 1:24-25.)

Bouevitch's COADM uses MEMS mirrors with 1 axis of rotation. (*E.g.*, Ex. 1003 at 7:23-37 (describing attenuation by tilting mirrors along one axis).)

C. Overview of the Sparks Prior Art

Like Bouevitch, Sparks is directed at MEMS-based WDM optical switch for communications. Sparks discloses "switching means arranged to switch an optical signal by redirection of the optical beam path of said signal, wherein said optical switch is arranged to misalign the optical beam path so as to provide a predetermined optical output power" (Ex. 1004 at Abstract.) Sparks "operates by controlling the movable micromirrors (16,26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the beams so as to ensure that the maximum possible input optical signal is received at the output of the switch." (Id. at 4:43-46.) Thus, to the extent Bouevitch does not disclose 2-axis mirrors and their intended use for power control, Sparks does.

D. PHOSITA had ample reason to combine Bouevitch with Sparks, including the motivations disclosed in both references

A person having ordinary skill in the art ("PHOSITA") at the time of the '368 Patent would have been an engineer or physicist with at least a Master's degree, or equivalent experience, in optics, physics, electrical engineering, or a related field, including at least three years of additional experience designing,

constructing, and/or testing optical systems. (McLaughlin Decl., Ex. 1028 at ¶ 11.) To the PHOSITA, Bouevitch and Sparks were combinable for purposes of establishing obviousness under 35 U.S.C. § 103(a). (*Id.*, ¶ 29-37.) Most of the *KSR* obviousness rationales support combining these two references. (*KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415-421 (2007); MPEP § 2141.)

First, Bouevitch and Sparks represent analogous art. Both Bouevitch and Sparks are directed to the same field: communication using optical switch multiplexors (Ex. 1003 at 1:10-15 and 31-34; Ex. 1004 at 4:3-14, 33-38, and 59-60). It is noted that Lin and Dueck are similarly directed to optical switch multiplexors (Lin, Ex. 1010 at Title; Dueck, Ex. 1021 at 3:3-5). This is the same field of endeavor as the '368 Patent (Bouevitch, Ex. 1003 Abstract.) Bouevitch and Sparks are both directed to the same application in that field: optical switching for multi-wavelength WDM communications. (Ex. 1003 at Abstract; Ex. 1004 at 2:30-36.) Furthermore, the actuating mirrors of Sparks and Bouevitch are both MEMS-based. (Ex. 1003 at 14:5-10 and 52-65; Ex. 1004 at 4:42-47). As such, Bouevitch and Sparks (and further Lin and Dueck) are analogous art and the PHOSITA would have understood that the teachings of any one reference would be readily applicable to the others. (McLaughlin Decl., Ex. 1028 at ¶ 30.)

Second, the use of Sparks' 2-axis mirrors in Bouevitch's system is a simple substitution of one known, closely-related element for another that obtains

predictable results. The 2-axis actuating mirrors are described by Sparks to "precisely direct[] the beam" (Ex. 1004 at 4:21) and to "carefully align the beams so as to ensure that the maximum possible input optical signal is received at the output of the switch" (Id. at 4:45-47.) The PHOSITA would expect that using the 2-axis MEMS-based mirrors of Sparks for directing a beam of light in place of the 1-axis MEMS-based mirrors of Bouevitch would yield a predictable result of the same functionality (e.g., movement of a reflective service in a first axis) yet with more control (e.g., the reflective surface moving in a second axis in similar manner as the movement in the first axis). (McLaughlin Decl., Ex. 1028 at ¶ 31.) Likewise, the power control teachings of Sparks "may equally be applied to any optical switch utilising any one or more of reflection, refraction and/or diffraction, in which the optical beam path through the switch can be misaligned so as to attenuate the resultant output signal." (Ex. 1004 at 5:58-62; McLaughlin Decl., Ex. 1028 at ¶ 36.) As a result, using the known 2-axis mirrors for power control in the Bouevitch switch is nothing more than the use of known techniques to improve similar devices with predictable results. (McLaughlin Decl., Ex. 1028 at ¶¶ 30-32, 35-36.)

Third, it would be obvious to try Sparks' 2-axis actuating mirrors in Bouevitch because 2-axis actuating mirrors were among a small number of identified, predictable solutions for mirror actuation and the PHOSITA had a high

expectation of success if Bouevitch's 1-axis actuating mirror were to be replaced with Sparks' 2-axis actuating mirror. (McLaughlin Decl., Ex. 1028 at ¶ 32.) Because Sparks already disclosed the use of 2-axis actuating mirrors by the '368 Patent's priority date, the PHOSITA would have a high expectation of success to try 2-axis mirror control in place of Bouevitch's 1-axis actuating mirror, both for switching and power control. (McLaughlin Decl., Ex. 1028 at ¶¶ 31-32, 36.)

Fourth, Sparks and Bouevitch provide explicit motivations to combine the references. Sparks addresses a problem, and is directed to a goal, identified in Bouevitch. Specifically, Bouevitch states that "[i]n WDM systems it is desirable to ensure that all channels have nearly equivalent power." (Ex. [1003] 1:20-22.) Directly on point, Sparks states that "[i]n wavelength division multiplexed (WDM) transmission, it is desirable to control the power of the individual optical channels or wavelengths . . .[o]ne of the simplest methods of control is to maintain each of the power levels of the individual wavelength components (channels) at substantially the same level." (Ex. 1004 at 1:19-25). To maintain the desired equal channel power levels, Sparks teaches "controlled misalignment of the optical beam path so as to achieve a predetermined optical output power . . . If the optical system is being used as part of a WDM system, it is typical for the signal to be demultiplexed into the separate optical channels prior to input to the switch. If desired, each of the channels passing through the switch may be attenuated to

whatever degree necessary to achieve the desired effect, e.g. equalisation of optical power across all channels." (Ex. 1004 at 2:24-36.) As such, the PHOSITA would have been motivated to utilize the 2-axis actuating mirror power control feature of Sparks for addressing the need, identified by Bouevitch, to help ensure that all channels have nearly equivalent power. (McLaughlin Decl., Ex. 1028 at ¶¶ 35-37.)

Finally, 2-axis mirrors, as in Sparks, were known to overcome manufacturing deviations by being actuatable to adjust for any unintentional misalignment in 2-axes. (McLaughlin Decl., Ex. 1028 at ¶¶ 34.) In conclusion, the teachings of Bouevitch are combinable with those of Sparks under §103(a).

E. Bouevitch and Sparks Render Obvious All Petitioned Claims

The Petitioner identifies below how Bouevitch in view of Sparks discloses each element of the Petitioned Claims, as well as element-specific motivations to combine the two references (and Lin and Dueck). Given the similarity of many of the Petitioned Claims, some of the explanations below refer to earlier discussions of the same or similar claims to avoid repetition. In such cases, the prior referenced discussions are incorporated fully by reference in the later explanations.

1. Claim 1 – Grounds 1 and 2

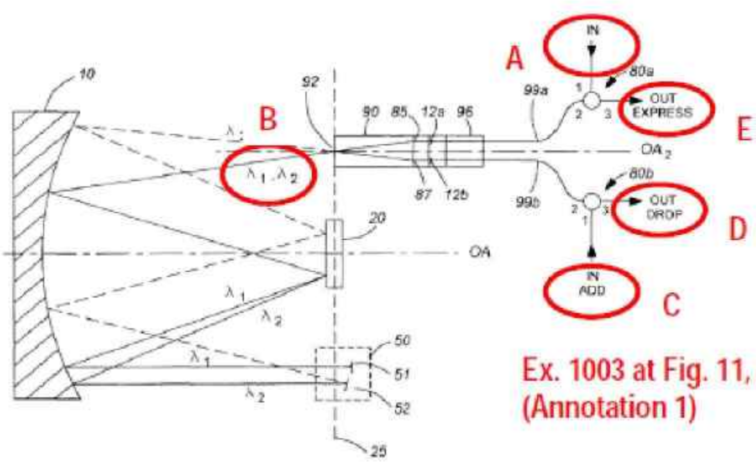
The section addresses claim 1 first under Petitioner's Ground No. 1 of Bouevitch+Sparks, and then under Ground No. 2 of Bouevitch+Sparks+Lin.

(1) Claim 1 - preamble

The preamble of claim 1 recites "[a]n optical add-drop apparatus comprising...." (Ex. 1001.) Bouevitch discloses a "Configurable Optical Add/Drop Multiplexer (COADM)." (Ex. 1003 at Abstract; *see also Id.*, 5:15–20; 14:14-21; Figs. 1, 11; 3:9-63 (discussing methods of using the COADM).)

(2) Claim element 1[a] - input port

The first limitation of claim 1 recites "an input port for an input multi-wavelength optical signal having first spectral channels." The patentee admitted in the reissue that Bouevitch discloses this element. (§ VI, above.) The explanation below confirms that the patentee was correct. Bouevitch discloses an input port "IN," annotated as "A" in Fig. 11-Annotation 1, included below. An optical signal is "launched into" the "IN" port. (*Id.*, 14:38–41.) That signal is a multi-wavelength signal with a first spectral channel λ1 and a second channel λ2, as shown at annotation "B" of Fig. 11-Annotation 1 (*Id.*, Fig. 11, 14:39-42, 10:56-61)



Ex. 1003 at Fig. 11, (Annotation 1)

(3) Element 1[b] – Output & other ports for 2nd channels

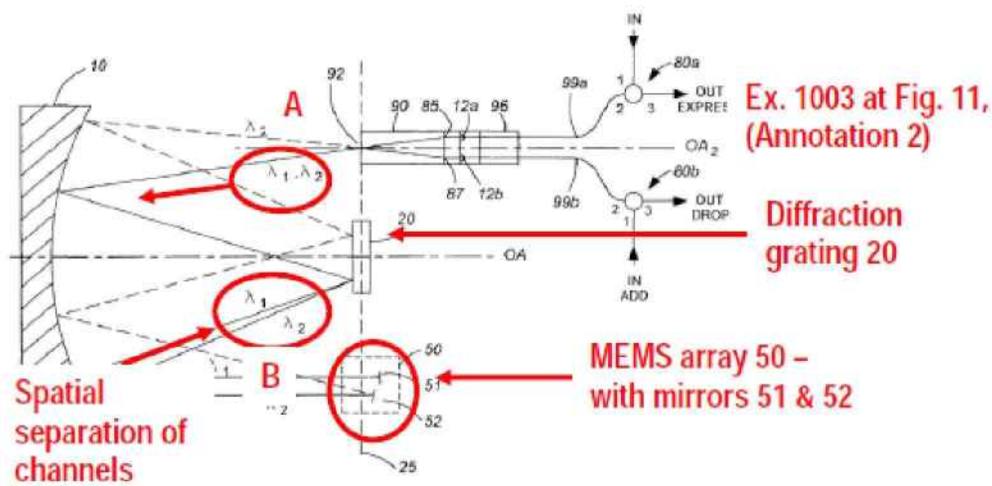
Other Ports: The first part of limitation 1[b] recites: “one or more other ports for second spectral channels.” Bouevitch discloses two ports in addition to the input and output ports. Bouevitch labels one port as 80b, port 1, “IN ADD” (annotated as “C” in *Id.*, Fig. 11-Annotation 1, above). Another is labeled as 80b, port 3, “OUT DROP” (annotated as “D”). (*Id.*) In one example, first spectral channel X2 exits the OUT DROP port, and Bouevitch adds a new second channel on the same wavelength X2 at the IN ADD port. (*Id.*, 14:27-65.) Although both the added and the dropped channels use the same wavelength, they are separate channels. (McLaughlin Decl., Ex. 1028 at ¶ 40.) Bouevitch discloses the “in/out/add/drop ports” as part of its “configurable add/drop multiplexor”. (*Id.*, 10:56-61, 1:11-15.)

Output Port: The second part of limitation 1[b] recites: “an output port for an output multi-wavelength optical signal.” Bouevitch discloses an output “OUT EXPRESS” output port (annotated as “E,” in Fig. 11-Annotation 1, above) wherein a multi-wavelength signal including one of the original input channels (wavelength X1) is combined with an added channel (X2), which together exit the output port 80a(3). “[T]he added optical signal corresponding to X2 is combined with the express signal corresponding to X1. The multiplexed signal...returns to port 2 of the first circulator 80a where it is circulated out of the device from port 3.” (*Id.*,

15:14-18; Fig. 11.)

(4) Element 1[c] - wavelength-selective device

The next element, 1[c], requires "a wavelength-selective device for spatially separating said spectral channels." Diffraction grating 20 in Bouevitch Fig. 11 is such a device. Figure 11 shows that the grating spatially separates combined channels λ1λ2 ("A" at Fig. 11-Annotation 2, below) into separated channels ("B"):



Bouevitch states, "[t]he emerging beam of light λ1 λ2, is transmitted to an upper portion of the spherical reflector 10, is reflected, ***and is incident on the diffraction grating 20, where it is spatially dispersed into two sub-beams of light carrying wavelengths 21 and 22, respectively***." (Ex. 1003 at 14:48-53 (emphasis added); 8:10–22; *see also* McLaughlin Decl., Ex. 1028 at ¶¶ 42-43, ¶¶ 97-99.)

(5) Element 1[d] – 2-axis beam-deflecting elements

This final element of claim 1 has three subparts. Bouevitch teaches the first two, and Sparks teaches the third. Each subpart is discussed in turn, below.

Beam-deflecting Elements: The first part of element 1[d] recites: "a spatial array of beam-deflecting elements positioned such that each element receives a corresponding one of said spectral channels." Bouevitch discloses this element as MEMS mirror array 50 in Fig. 11-Annotation 2, above. Bouevitch positions its MEMS mirrors to receive and reflect the beams of light carrying the respective spectral channels dispersed by the diffraction grating. Bouevitch discloses "modifying and reflecting a beam of light spatially dispersed by the dispersive element" where, for COADM operations, the "modifying means is preferably a MEMS array 50." (Ex. 1003 at 3:42–45; 14:26-27.) Each mirror in the MEMS array (elements 51 and 52 for Fig. 11-Annotation 2, above) reflects a separate, corresponding beam of light (channels λ1 & λ2 respectively) such that the channel reflected by mirror 51 is passed though, and the channel reflected by 52 is dropped. (Bouevitch, Ex. 1003 at 14:52-63, Fig. 11.)

Individually / Continuously Controllable: The second part of limitation 1[d] recites wherein each of the elements of the array is "individually and continuously controllable in two dimensions to reflect its corresponding spectral channel to a selected one of said ports." The BRI of controllable "in two dimensions" means controllable "in two axes." The BRI of "continuously controllable" is "able to effect changes with fine precision."

First, Bouevitch discloses "individual" control of each mirror in MEMS

array 50. "[E]ach sub-beam of light...is transmitted to separate reflectors 51 and 52 of the MEMS array 50." (*Id.* at 14:52-63, 10:47-51, Fig. 11-Annotation 2). Each reflector is individually controlled in one axis to deflect the respective beam to either the output or the drop port. (*Id.*; *see also* McLaughlin Decl., Ex. 1028 at ¶ 47.)

Second, Bouevitch and Sparks both indicate that their reflectors are able to effect changes with fine precision, and therefore are within the scope of the BRI of the term "continuously controllable" (§ VII.B above). Specifically, Bouevitch states that "the beam of light becomes circularly polarized and is incident on a predetermined reflector of the MEMS array 155. The reflector reflects the sub-beam of light incident thereon back to the quarter waveplate. The degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)" (Ex. 1003 at 7:31-37.) Bouevitch also describes the attenuation resulting from the deflector as "variable." (*Id.*, 12:59-60; McLaughlin Decl., Ex. 1028 at ¶ 48.) Therefore, the reflector of the MEMS array 155 is controllable to achieve any needed degree of attenuation and is able to effect changes with fine precision.

Furthermore, in view of the '368 Patent providing analog control as an example of continuously controllable (*see* § VII.B above), Bouevitch indicates that its reflectors are "continuously" controllable because the amount of power the

device attenuates is a direct (e.g., analog) function of the angle of the deflector in that one axis. (Ex. 1003 at 7:35-37 ("The degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)"; McLaughlin Decl., Ex. 1028 at ¶ 48.)) Bouevitch also describes the attenuation resulting from the deflector as "variable." (*Id.*, 12:59-60; McLaughlin Decl., Ex. 1028 at ¶ 48.))

Sparks teaches "switching means arranged to switch an optical signal by redirection of the optical beam path of said signal, the method comprising controlled misalignment of the optical beam path so as to achieve a predetermined optical output power . . . each of the channels passing through the switch may be attenuated to whatever degree necessary to achieve the desired effect" (Ex. 1004 at 2:21-35.) Sparks states that the mirrors are actuatable "to achieve any desired optical beam power output less than the maximum" (Id. at 4:54-55.) As such, Sparks teaches that its reflectors are able to effect changes with fine precision, and therefore are within the scope of the BRI of the term continuously controllable. (McLaughlin Decl., Ex. 1028 at ¶ 49.)

Furthermore, in view of the '368 Patent providing analog control as an example of continuously controllable (*see* § VII.B above), Sparks' statements that "channels passing through the switch may be attenuated to **whatever** degree necessary" (Ex. 1004 at 2:33-35, emphasis added) to "achieve **any** desired optical

beam power output" (*id.* at 2:54-55, emphasis added) denotes sufficiently fine precision consistent with analog control. (McLaughlin Decl., Ex. 1028 at ¶ 49.)

(6) Ground 2 – Bouevitch + Sparks + Lin

Petitioner asserts that Ground 1 is sufficient for institution. Bouevitch + Sparks discloses all claimed elements, including the "continuously" limitation. Ground 2 adds one additional reference, Lin, to Ground 1 to further address the "continuously" limitation. If the Board decides that Bouevitch + Sparks does not adequately disclose the "continuously" limitation, then the Board should adopt Ground 2.

Under Ground 2, U.S. Patent No. 5,661,591 to Lin also teaches continuous, analog control of MEMS mirrors. (McLaughlin Decl., Ex. 1028 at ¶ 51.) As discussed below, it would be obvious to combine Lin's continuous, analog control with Bouevitch and Sparks. For example, Figure 3B of Lin shows a graph disclosing the continuous deflection angle of MEMS mirrors as a function of the voltage applied to affect that deflection. Figure 3B shows the relationship as continuous and linear:

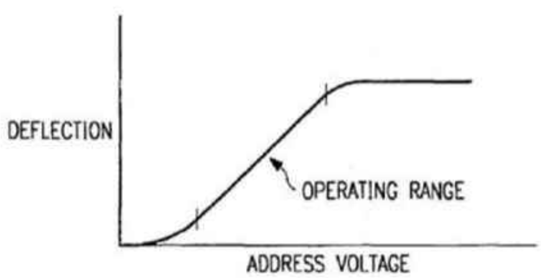


FIG. 3B

To the extent Bouevitch does not fully disclose analog (as continuous)

mirror control, it also would have been obvious to substitute one control method for the other, including substituting Sparks' or Lin's analog control into the COADM of Bouevitch. (McLaughlin Decl., Ex. 1028 at ¶¶ 52-55.) The PHOSITA would combine the teachings of these references at least for the reasons that (1) continuously controlled mirrors were known to be interchangeable with discrete-step mirrors; (2) continuously controlled mirrors allow arbitrary positioning of mirrors and can more precisely match the optimal coupling value; and (3) Lin specifically teaches that its analog, continuous MEMS mirrors would be useful in optical switching applications like Bouevitch's and Sparks' optical switch devices. (Lin, Ex. 1010 at 2:6-9; McLaughlin Decl., Ex. 1028 at ¶ 52.)

In addition, analog (continuous) control of the mirrors would be obvious to try because there are only two general options for such control—either analog (continuous) or discrete (step-wise) control. (McLaughlin Decl., Ex. 1028 at ¶ 53.) For example, Lin discusses analog control as the alternative to binary (discrete) control of mirrors to increase the precision of the mirror placement. (*Id.*, 2:7-9; 3:41-57; McLaughlin Decl., Ex. 1028 at ¶¶ 51-52.) With two principal options, both of which were known in the prior art, and both of which were suggested as working solutions for control, PHOSITA would have expected that trying analog control would work well in the device of Bouevitch. (McLaughlin Decl., Ex. 1028 at ¶¶ 52-55.)

(7) 2-axis beam-deflecting elements

Returning now to both Grounds 1 and 2, the only portion of this part of element 1[d] arguably not taught by Bouevitch is a beam deflecting element with a second dimension ("axis" under Petitioner's BRI) of control. But as discussed in § VIII.C, Sparks discloses a 2-axis beam deflecting element. In particular, Sparks describes "movable micromirrors (16,26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the beams so as to ensure that the maximum possible input optical signal is received at the output of the switch." (Ex. 1004 at 4:43-47; McLaughlin Decl., Ex. 1028 at ¶ 56.)

For at least the reasons discussed in § VIII.D, above, it would be obvious (and PHOSITA would be motivated) to exchange the 1-axis actuating mirrors in Bouevitch with the 2-axis actuating mirrors of Sparks. (McLaughlin Decl., Ex. 1028 at ¶¶ 30-37.) For example, the use of Sparks' 2-axis MEMS mirror in place of Bouevitch's 1-axis MEMS mirror is a simple substitution of a known, closely-related element for another that obtains predictable results, as discussed above. (§ VIII.D.)

Replacing Bouevitch's 1-axis mirrors with Sparks' 2-axis mirrors had the known benefit of minimizing the resulting device's size, which is desirable in optical devices. (Bouevitch, Ex. 1003 at 2:9-21; McLaughlin Decl., Ex. 1028 at ¶ 58.) Size reduction results from "minimal spacing between crossconnect

components," (Ex. 1006 at 3:10-11), and PHOSITA knew that 2-axis mirrors allow for beam-steering between more compactly-spaced input/output ports arranged as a 2-D array. (Hoen, Ex. 1009 at 1:652:13.) The patentee itself acknowledged the need for 2-axis mirrors in the '368 Patent, saying that when the input and output ports are arranged in a 2-D array, "the channel micromirrors must be pivotable biaxially." (*Id.*, 4:26-29; *see also* McLaughlin Decl., Ex. 1028 at ¶ 58.).

With respect to the last term of this portion of 1[d] ("to reflect its corresponding spectral channel to a selected one of said ports"), Bouevitch describes how the goal of controlling the MEMS mirrors is to effect the add/drop process, which includes reflecting the spectral channels to selected add/drop ports. (See, e.g., Ex. 1003 at 14:66-15:18.) Similarly, Sparks discusses "having two arrays of such modules, optical signals coming in from a first array may be directed into any of the output fibres of the second array." (Ex. 1004 at 4:33-35.) As such, both Bouevitch and Sparks disclose switches to "redirect a spectral channel to a particular port". (McLaughlin Decl., Ex. 1028 at ¶ 60.)

(8) Power Control using 2-Axis Mirrors:

The third part of element 1[d] recites wherein each of the beam-deflecting elements is controllable "to control the power of the spectral channel reflected to said selected port." As discussed in the BRI section, this statement of intended use, and therefore should not be limiting in the first instance. However, in an abundance

of caution, Petitioner addresses this language as if it were limiting.

Bouevitch discusses power control by tilting one-axis mirrors to effect a slight misalignment between the beam and the output port. Bouevitch shows how each MEMS mirror controls the power of a "respective" channel, where "the degree of [power] attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)." (*Id.* 1:24-27, 7:23-37; *see also Id.*, 1:21-24, 50-53; 5:16-46; 2:22-25; Abstract; *see also* McLaughlin Decl., Ex. 1028 at ¶ 61.)

Sparks discusses 2-axis (two dimensional) mirror actuation for both switching (Ex. 1004 at 4:33-35) and power control (*Id.* at Abstract). Regarding power control, Sparks states "a control system to control the mirrors so as to deliberately misalign the optical beam path 30 through the switch. By non-optimally aligning the optical beam path, the optical beam will be attenuated as it passes through the switch due to a reduction in the power of the beam coupled into the output fibre." (Id. at 4:48-53; *see also* McLaughlin Decl., Ex. 1028 at ¶ 62.)

The PHOSITA would be motivated to use the 2-axis system of Sparks within the system of Bouevitch for power control. (McLaughlin Decl., Ex. 1028 at ¶¶ 63-64.) First, power control was desirable generally and would be just as desirable after switching to 2-axis mirrors for the benefits cited above. Bouevitch notes both the desirability of power equalization across spectral channels, and the need for devices that perform both power control and add/drop functions.

(Bouevitch, Ex. 1003 at 1:18; 1:50-42.) The patentee also recognized this, claiming that ("spectral power-management capability is essential in WDM optical networking applications.") (Ex. 1001 at 11:21-24; *see also* McLaughlin Decl., Ex. 1028 at ¶ 63.)

Second, the PHOSITA would be further motivated to utilize the 2-axis actuating mirror and power control feature of Sparks to address a need identified by Bouevitch. Bouevitch states "In WDM systems it is desirable to ensure that all channels have nearly equivalent power." (Bouevitch, Ex. 1003 at 1:21-22.) The power control feature of Sparks can be used to "maintain each of the power levels of the individual wavelength components (channels) at substantially the same level" (Ex. 1004 at 1:23-25) by "controlled misalignment of the optical beam path so as to achieve a predetermined optical output power . . . each of the channels passing through the switch may be attenuated to whatever degree necessary to achieve the desired effect, e.g. equalisation of optical power across all channels." (Ex. 1004 at 2:24-36; *see also* § III.D, above; McLaughlin Decl., Ex. 1028 at ¶¶ 64-66.)

2. Claim 2

Claim 2 recites "the optical add-drop apparatus of claim 1 further comprising a control unit for controlling each of said beam-deflecting elements." Bouevitch must contain a control unit for controlling the tilt on the individual

mirrors (50, 51) in the MEMS array (50). (McLaughlin Decl., Ex. 1028 at ¶ 67-71.) But rather than rely on this inherent property of Bouevitch, Petitioner will address this element in terms of obviousness.

It would be obvious to PHOSITA to add a known control unit to Bouevitch, such as the Sparks control unit, because the Bouevitch device is required to function with some type of control unit. The "selective switching" that Bouevitch performs with its MEMS mirrors would need to be performed by some type of control unit, accepting commands for switching state change from a remote network controller, and in response issuing the actuation controls required for completing the switching function. (McLaughlin Decl., Ex. 1028 at ¶¶ 67-70.) Individual mirrors could not otherwise be manually aligned and maintained in accuracy necessary for the switching operation. (*Id.* at ¶ 70.)

Moreover, Sparks discloses control means 130 for controlling the actuation of the switching means 120 (Ex. 1004 at 4:61-65, Fig. 4). The control means can be a "closed-loop servo control system" employed for "controlling the movable micromirrors (16,26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the beams" (*Id.* at 4:39-45.) The "control system is used to control the mirrors so as to deliberately misalign the optical beam path 30 through the switch" to obtain "a reduction in the power of the beam" (*Id.* at 4:48-53.). The PHOSITA would have readily understood that the

control system of Sparks would have been suitable for controlling the 2-axis actuating mirror of Sparks when incorporated in Bouevitch if there was any doubt over whether a controller of Bouevitch would be able to do the same. (McLaughlin Decl., Ex. 1028 at ¶ 72.)

To the extent Bouevitch does not already disclose a "control unit," adding the control unit of Sparks (or other control units) to Bouevitch would have been obvious to the PHOSITA because control units were known elements with almost universal applicability. (Ex. 1004 at 4:39-53; McLaughlin Decl., Ex. 1028 at ¶ 73.) The PHOSITA could have added such a control unit to Bouevitch with no change in the unit's functions (to act as a controller of electronic elements). This addition would have yielded the predictable result of electronic control to one of ordinary skill in the art. (McLaughlin Decl., Ex. 1028 at ¶ 73.) And as previously stated, optical communications requires accurate switching. (McLaughlin Decl., Ex. 1028 at ¶¶ 70, 87.) A control unit that realigns the mirrors in configurable OADM would maintain that accuracy. (*Id.*, at ¶¶ 67-73, 87.) A control unit would also affect the power feedback loop in a timely fashion. (*Id.; see also id.* at ¶ 80.)

3. Claim 3

Claim 3 has two parts, referred to in this section by the shorthand "servo-control assembly" and "spectral monitor."

Servo Control Assembly: The "servo-control assembly" part of Claim 3 fully recites "wherein the control unit further comprises a servo-control assembly." As discussed in the BRI section, above, the BRI of a "servo-control assembly" is a "feedback-based control assembly." (*See* § VII.F, above.) The '368 Patent explains how its servo-control assembly measures the actual output power and then uses that measurement in a feedback loop to further adjust the MEMS mirrors to ensure that the output power remains where it should. (*See* McLaughlin Decl., Ex. 1028 at ¶ 75.)

Sparks discloses such a servo control assembly. Specifically, Sparks discloses a "closed-loop servo control system" employed for "controlling the movable micromirrors (16,26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the beams" (Ex. 1004 at 4:39-45.) The "control system is used to control the mirrors so as to deliberately misalign the optical beam path 30 through the switch" to obtain "a reduction in the power of the beam" (*Id.* at 4:48-53; McLaughlin Decl., Ex. 1028 at ¶ 76.)). A spectral monitor, discussed below, is provided in Sparks with an output to a controller. (Ex. 1004 at 2:59-65, 4:61-67.) Sparks teaches an internal feedback loop between a controller, an optical switch having 2-axis actuating mirrors, and a channel power monitor. (Ex. 1004 at 4:61-67 & Fig. 4; McLaughlin Decl., Ex. 1028 at ¶ 76.))

It would be obvious to PHOSITA to try the feedback loop in Sparks for use in Bouevitch as an alternative to the "external feedback" for power control that Bouevitch explains should be eliminated. (*Id.* at 10:17-21; McLaughlin Decl., Ex. 1028 at ¶ 77.) This is obvious because the principal alternatives to provide such feedback would be the use of (1) internal or (2) external feedback. (McLaughlin Decl., Ex. 1028 at ¶¶ 77-78.) Using the Sparks internal feedback technique was known (*id.*), and one of skill would be motivated to do so to allow for the use of internal feedback to respond to power levels. (*Id.*; *see also* '368 Patent, Ex. 1001 at 12:9-15 ("The electronic circuitry and the associated signal processing algorithm/software for such processing unit in a servo-control system are known in the art."))

Spectral Monitor: The spectral monitor portion of claim 3 more fully requires the control unit to "include[] a spectral monitor for monitoring power levels of selected ones of said spectral channels, and a processing unit responsive to said power levels for controlling said beam deflecting elements." The BRI for the term "spectral monitor" is "a device for measuring power in a spectral channel."

Sparks discloses a "power measuring means 140 is arranged to provide a signal indicative of the power of the optical signal to the switching means." (Ex. 1004 at 4:65-67; *see also id.* at Fig. 4.) Sparks provides that "only a single

indication of the optical signal power is necessary . . . Alternatively, both the input and the output optical signal to the switch could be measured in order to directly indicate the degree of the attenuation of the optical signal as it passes through the switch. This information could be used to provide a closed loop feedback control system to ensure that the desired degree of attenuation is achieved for each optical signal (or channel)." (Ex. 1004 at 2:52-65.)

It would have been obvious to the PHOSITA to use the spectral monitor of Sparks within the Bouevitch ROADM as this would have been the mere combining of known prior art elements according to their known methods to yield predictable results. (McLaughlin Decl., Ex. 1028 at ¶ 81.) As the patentee stated in the '368 Patent, a "skilled artisan will know how to implement a suitable spectral monitor along with an appropriate processing unit to provide a servo-control assembly in a WSP-S apparatus according to the present invention, for a given application." (Ex. 1001 at 12:11-15.) PHOSITA would also understand that the feedback from the monitor would need to be processed to turn the power measurement into control signals for the mirrors. (McLaughlin Decl., Ex. 1028 at ¶ 81-82.) For example, the processor would need to determine the amount of tilt change required on the mirrors to adjust the power output. (*Id.* at ¶ 81-82.) The PHOSITA had ample motivation to combine the Sparks feedback loop within Bouevitch because PHOSITA would appreciate that the feedback-driven control of Sparks would

improve the precision of the mirror-based switching system of Bouevitch. (*Id.* at ¶ 81-82.) As a contemporary document in the optical switching field stated "the actuation method for [micromirrors] is often imprecise. To achieve a variable switch, it is typically necessary to use a very high level of optical feedback." (Hoen, Ex. 1009 at 2:4-9; *see also* McLaughlin Decl., Ex. 1028 at ¶ 82.)

4. Claim 4

Claim 4 recites "The optical add-drop apparatus of claim 3, wherein said servo-control assembly maintains said power levels at predetermined values." The servo-control assembly of Sparks has been addressed above in connection with the discussion of claim 3. (§ VII.E.3.) Sparks makes clear that the closed-loop power control feature carries out "controlled misalignment of the optical beam path so as to achieve a predetermined optical output power" (Ex. 1004 at 2:24-25; *see also Id.* at Abstract.) Being that the intentional misalignment can be carried out on a channel-by-channel basis as needed to equalize the power levels of all channels (*Id.* at 2:33-38), the PHOSITA wound understand that the power levels of multiple channels can be maintained at predetermined values.

It would have been obvious to try the predetermined power settings of Sparks within Bouevitch, because there are only a limited set of types of power settings to use: predetermined and not-predetermined. (McLaughlin Decl., Ex. 1028 at ¶ 86.) The PHOSITA would have expected a likelihood of success using

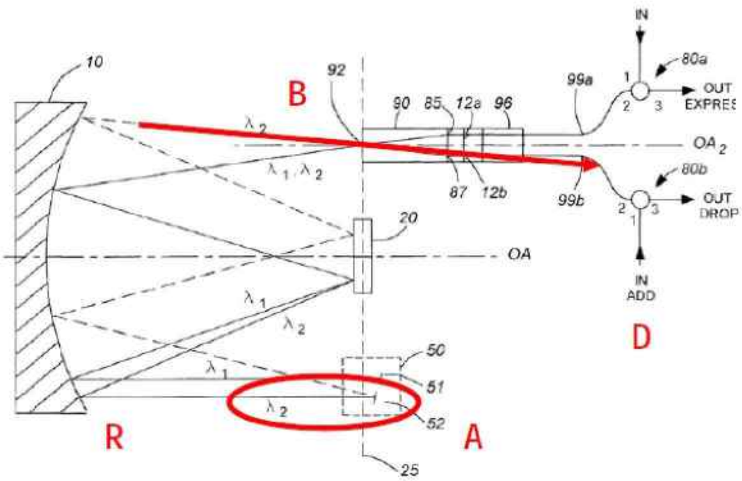
predetermined values based at least in part on Sparks. (*Id.* at ¶ 86.) Bouevitch states that "it is desirable to ensure that all channels have nearly equivalent power" (Ex. 1003 at 1:21-22) and the servo-control of Sparks can be used to "maintain each of the power levels of the individual wavelength components (channels) at substantially the same level" (Ex. 1004 at 1:23-25.) As such, the PHOSITA would have been motivated to implement the servo-control assembly of Sparks in Bouevitch to maintain said power levels at predetermined values.

5. Claim 5

Claim 5 recites "The optical add-drop apparatus of claim 2, wherein the control unit controls said beam-deflecting elements to direct selected ones of said first spectral channels to one or more of said second ports to be dropped as second spectral channels from said output multi-wavelength optical signal." Bouevitch is an add-drop multiplexer, and as such, discloses the ability to direct channels to a drop port. (*See* § VIII.E.1(3), above.)

Petitioner has included Figure 11-Annotation 3 from Bouevitch below. In this figure, beam-deflecting mirror 52 (annotation "A") directs the channel associated with λ2 along a different path ("B") than the λ1 channel and finally out of "OUT DROP" port 3 of 80b ("C"). Accordingly, the Figure illustrates the exact path that a spectral channel, once separated from the other channels, would follow

to be dropped. (Bouevitch, Ex. 1003, Fig 11, 14:60-65; McLaughlin Decl., Ex. 1028 at ¶ 88.)



Ex. 1003 at Fig. 11, (Annotation 3)

As explained for claim 2, above, it would be obvious to use the "control unit" implicit in Bouevitch or plainly disclosed in Sparks to control MEMS mirror 52 to perform this selective beam dropping. (§ VIII.E.2; Ex. 1004 at Fig. 4, 4:39-65; McLaughlin Decl., Ex. 1028 at ¶ 89.) To achieve switching accuracy necessary to support an optical communications application, a control unit would be necessary to position the individual mirrors 51 and 52. (*See* § VIII.E.2, above.)

6. Claim 6

Claim 6 recites "The optical add-drop apparatus of claim 2, wherein the control unit controls said beam-deflecting elements to direct selected ones of said second spectral channels to said output port to be added to said output multi-wavelength optical signal." This claim is similar to claim 5 except that it relates to adding a channel rather than dropping a channel.

Bouevitch discloses a configurable optical add drop module. (§ VIII.E.1(1), above.) It is designed to both drop and add channels to a multi-wavelength signal. (§ VIII.E.1(3), above; McLaughlin Decl., Ex. 1028 at ¶¶ 90-92.) Bouevitch illustrates the IN ADD port in Figure 11—shown as annotation D in Figure 11-Annotation 3 above—and explains in the corresponding specification portions that channel λ2 enters at the IN ADD port and is combined with channel λ1. The combined channels exit together. (Ex. 1004 at 14:66-15:18.)

Bouevitch would have performed this addition with a control unit. (McLaughlin Decl., Ex. 1028 at ¶ 90-92.) But to the degree that the control unit in Bouevitch was not inherent, it would be obvious to use Sparks' control unit (Ex. 1004 at Fig. 4, 4:39-65) to perform this channel addition. (§VIII.E.2; McLaughlin Decl., Ex. 1028 at ¶ 89-92.) Use of Sparks' control unit in the system of Bouevitch, which requires control to adjust mirrors as discussed above, merely combines known prior art elements according to known methods to yield predictable results.

7. Claim 9

Claim 9 recites "The optical add-drop apparatus of claim 1, wherein said wavelength selective device further combines selected ones of said spectral channels reflected from said beam-deflecting elements to form said output multi-wavelength optical signal." Bouevitch discloses this combination of channels when a channel is added and then combined with an existing channel. For example,

Bouevitch explains, "[a]t the diffraction grating, the added optical signal corresponding to λ2 is combined with the express signal corresponding to λ1. The multiplexed signal is returned to the lens 90, passes through port 85, and returns to port 2 of the first circulator 80a where it is circulated out of the device from port 3." (Ex. 1003 at 15:13-18, Figure 11; McLaughlin Decl., Ex. 1028 at ¶ 93.)

8. Claim 10

Claim 10 recites "The optical add-drop apparatus of claim 1, wherein said one or more other ports comprise an add port and a drop port for respectively adding second and dropping first spectral channels." Bouevitch discloses these ports at the "IN ADD" port and the "OUT DROP" port. (Ex. 1003, Fig. 11; 14:62–15:1; McLaughlin Decl., Ex. 1028 at ¶ 94.) For convenience, Petitioner labeled the ports in Fig. 11-Annotation 3, above. IN ADD port is labeled as "D" and the "OUT DROP" port is labeled as C. Petitioner previously discussed these two ports when addressing claims 5 and 6. (*See* §§ VIII.E.5, VIII.E.6.)

9. Claim 11

Claim 11 recites "The optical add-drop apparatus of claim 1 further comprising a beam-focuser for focusing said separated spectral channels onto said beam deflecting elements." As discussed in the BRI section VII.H, above, the BRI for the term "beam focuser" is "a device that directs a beam of light to a spot."

Bouevitch discloses this beam-focuser element at reflector 10 in Figure 11. Referring to Figure 11-Annotation 3 above, reflector 10 directs the separated beams of light λ1 and λ2 from the points on the reflector annotated as R onto the corresponding beam deflecting mirrors 51 and 52 in MEMS array 50. (McLaughlin Decl., Ex. 1028 ¶ 96; Ex. 1003, Figs. 11, 6a, 15:7-11, 14:14-20, 48-55; *see also* Sparks, Ex. 1004 at 12:43-50 ("A lens system 202 focuses the beams onto a MEMS mirror array").) Bouevitch's description of other examples of reflector 10 (examples that Bouevitch describes as compatible with the Fig. 11) confirms that the reflector focuses channels onto the MEMS mirrors. Specifically, "The plurality of ***sub-beams of light*** are transmitted to the spherical reflector **610** where they are collimated and transmitted to the modifying means **150** where they ***are incident thereon as spatially separated spots*** corresponding to individual spectral channels." (*Id.*, 10:41-47; emphasis added; McLaughlin Decl., Ex. 1028 at ¶ 96.) The "modifying means 150" includes the MEMs array 50 of Fig. 11. (*Id.*)

10. Claim 12 – Grounds 1, 2, 3 and 4

Claim 12 recites "The optical add-drop apparatus of claim 1, wherein said wavelength-selective device comprises a device selected from the group consisting of ruled diffraction gratings, holographic diffraction gratings, echelle gratings, curved diffraction gratings, and dispersing prisms." Petitioner discusses below four separate grounds under which claim 12 is obvious.

Under Ground 1 (Bouevitch+Sparks), Bouevitch discloses the claimed wavelength-selective element in the form of a prism. As discussed further below, the use of a prism as recited in claim 12 was obvious.

Under Ground 2, Petitioner adds Lin to Bouevitch+Sparks, should the Board decide that Ground 1 does not disclose "continuously." (*See* ¶ VIII.E.1(6), above) Because ground 2 includes Bouevitch, Claim 12 is obvious under Ground 2 for the same reasons as Ground 1.

Ground 3 is only necessary should the Board find that neither Grounds 1 nor 2 describe the "wavelength-selective device" of Claim 12. Under Ground 3 (Bouevitch+Sparks+Dueck, also discussed below), Petitioner adds the Dueck reference to Ground 1 to further disclose "ruled diffraction gratings" and support the obviousness of using these gratings in the system of claim 12.

Under Ground 4, Petitioner adds Dueck to Ground 2. Claim 12 is obvious under Ground 4 (Bouevitch+Sparks+Lin+Dueck) for the same reasons as Ground 3.

Returning now to Grounds 1 and 2, it would have been obvious under either ground to use any of the types of wavelength-selective devices recited in claim 12. Each type was known in the prior art, each was interchangeable as a wavelength-selective device, and each was one of a small set of possible choices. (McLaughlin Decl., Ex. 1028 at ¶¶ 98-99.) For example, Bouevitch discloses the use of prisms as

wavelength-selective devices through Bouevitch's incorporation by reference of U.S. Patent No. 5,414,540 ("Patel"). Patel notes that prisms are one type of "frequency-dispersive mediums" that include diffraction gratings. (Ex. 1031 at 3:20-36 (incorporated in Bouevitch, Ex. 1003 at 1:37-39).) Sparks states that the switch can be "a controllable diffraction grating" type. (Ex. 1004 at 5:36-38.)

Under Ground 3, it was obvious to combine Bouevitch+Sparks with other teachings of specific types of wavelength-selective devices for WDM, including Dueck. Dueck discusses "ruled diffraction gratings." (Ex. 1021 at 6:26-30; McLaughlin Decl., Ex. 1028 at ¶¶ 98-99; *see also* Ranalli, Ex. 1027 at 6:33-36 (discussing "grating prisms").) It would be obvious to try Dueck's ruled diffraction gratings in the devices of Bouevitch and Sparks. (*Id.*) The PHOSITA would be motivated to do so because Dueck describes its grating as part of the "best mode" of separating wavelengths in WDM devices, which include the Bouevitch and Sparks devices. (Ex. 1021 at 6:26-30*; McLaughlin Decl., Ex. 1028* at ¶¶ 98-99.) Similarly, under Ground 4, it was obvious to combine Bouevitch+Sparks+Lin with Dueck for the same reasons given for Ground 3. (*Id.*)

11. Claim 13

Claim 13 recites "The optical add-drop apparatus of claim 1, wherein said beam-deflecting elements comprise micromachined mirrors." The MEMS (micro electromechanical systems) 1-axis and 2-axis mirrors discussed in Bouevitch and

Sparks are beam-deflecting "micromachined mirrors." (McLaughlin Decl., Ex. 1028 at ¶ 100.) MEMS are often described in the prior art as "micromachined mirrors." (*See, e.g.*, Goldstein, 3:48-50 ("In free-space MEMS crossconnects, micromachined mirrors are utilized as the switching elements."); *see also* § VIII.E.1(5) (discussing element 1[d], above); McLaughlin Decl., Ex. 1028 at ¶ 100.)

12. Claim 15 – Grounds 1 and 2

Claim 15 is an independent claim that very closely resembles claim 1. The preamble and first two elements of claim 15 are identical to the preamble and elements [a]-[b] of claim 1. These elements are disclosed by Bouevitch for the same reasons set forth in claim 1. (§ VIII.E.1) To avoid unnecessary repetition, those arguments are not copied here. They are incorporated by reference. As in claim 1, Petitioner again points to Sparks+Bouevitch under Ground 1. To the extent the Board disagrees that the "continuously" element is not present under Ground 1, Petitioner also analyzes claim 15 under Ground 2 of Sparks+Bouevitch+Lin by incorporating that analysis from claim 1 here.

The remaining elements of claim 15 are discussed below. The only substantive difference between the rest of claim 15 and the other elements of claim 1 is that claim 15 replaces the "other ports" of claim 1 with "drop ports" for

dropped channels. But this change does not impact validity. The differences are expressly disclosed in the applied references.

(1) Element 15[c] – drop ports for dropped channels

Claim 15 recites "one or more drop ports for selected spectral channels dropped from said multi-wavelength optical signal." Petitioner identifies this element as element 15[c]. Bouevitch discloses the "drop port" of element 15[c] as the "OUT DROP" port in element 80b port 3. Petitioner labels this port as "D" in Fig. 11-Annotation 1 in § VIII.E.1(2), above. This drop port is used for dropped channels. A spectral channel with wavelength λ2 is dropped from the combined λ1 and λ2 multi-wavelength input signal and sent out the OUT DROP port. (Bouevitch, Ex. 1004 at 14:27-65; § VIII.E.1(3) (discussing element 1[b], above); McLaughlin Decl., Ex. 1028 at ¶ 103.)

(2) Element 15[d]-[e]

The next element of claim 15— referred to as 15[d], recites "a wavelength-selective device for spatially separating said multiple spectral channels." This is identical to claim 1[c], and is disclosed by Bouevitch for the same reasons discussed for 1[c]. (§ VIII.E.1(4).)

The next element of claim 15—15[e]—recites "a spatial array of beam-deflecting elements..." This element is identical to claim 1[d] and is disclosed by Bouevitch+Sparks for the same reasons discussed for 1[d], above. (§ VIII.E.1(5).)

(3) Element 15[f] – dropped channels to drop ports

Finally, the last element of claim 15, identified here as 15[f], recites "whereby a subset of said spectral channels is directed to said drop ports." As discussed in the BRI section, this element should not be limiting. But even if it is limiting, Bouevitch discloses dropping subset channel λ2 from the combined set of channels λ1 and λ2 and directing λ2 out the OUT DROP port. (Ex. 1003 at 14:27-65; § VIII.E.12(1) & VIII.E.1(3) (15[c] and 1[b], above); McLaughlin Decl., Ex. 1028 at ¶106.)

13. Claim 16 – Grounds 1 and 2

Claim 16 is another independent claim. The only difference between claim 16 and claim 15, above, is that claim 16 focuses on add ports instead of drop ports. Claim 16 recites one or more ***add*** ports for ***adding*** channels to the multi-wavelength output channel instead of one or more ***drop*** ports for ***dropping*** channels. Specifically, claims 15 and 16 are identical but for claim 16's recitation of element 16[c]: "one or more add ports for selected spectral channels to be added to said output multi-wavelength optical signal," and 16[e]: "whereby said spectral channels from said add ports are selectively provided to said output port."

Thus, Bouevitch+Sparks under Ground 1 or Bouevitch+Sparks+Lin disclose all elements of claim 16 (other than [c] & [e]) for the same reasons as discussed for claim 15, above. (*See* §VIII.E.12.) This same combination also teaches elements

16[c] & [e], as discussed below.

(1) Element 16[c] – Add ports for added channels

Element 16[c] recites "one or more add ports for selected spectral channels to be added to said output multi-wavelength optical signal." Bouevitch discloses an "add" port in Figure 11. Figure 11 shows the port as 80b port 1, labelled "IN ADD" (annotated as "C" in *Id.*, Fig. 11-Annotation 1, § VIII.E.1(2), above). (*See* §§ VIII.E.1(3), VIII.E.6 (discussing element 1[b] and claim 6, above); McLaughlin Decl., Ex. 1028 at ¶ 109.) Bouevitch explains that the purpose of the add port is for allowing a selected subset of channels to be added to a multi-wavelength signal. Specifically, Bouevitch adds spectral channel λ2 at the IN ADD port. (Ex. 1003, 14:27-65.) Channel λ2 is then added into the output multi-wavelength optical signal. (*Id.*, 14:66-15:18 (channel λ2 entering at annotation "D" in Fig. 11-Annotation 1 is added to another channel (λ1), which together exit output port "C").)

(2) Element 16[e] – Addition of channels from add ports

With respect to element 16[e] ("whereby said spectral channels from said add ports are selectively provided to said output port"), Bouevitch teaches that added channel λ2 from the IN ADD port is selectively added to the final output channel that exits the "OUT EXPRESS" port (annotated as "E," in Fig. 11-Annotation 1, above). Depending on the orientation of MEMS mirror 52 in Fig. 11,

the added channel λ2 is either directed to the OUT EXPRESS port, or is reflected back along the same optical path to the ADD port from where it originated, thus dropping the channel. (Ex. 1003, 14:38-15:18; McLaughlin Decl., Ex. 1028 at ¶ 110.)

14. Claim 17 – Grounds 1 and 2

Claim 17 is a method claim version of claim 1 with very minor additions. The preamble of claim 17 recites "A method of performing dynamic add and drop in a WDM optical network." Bouevitch describes a method for operating a "Configurable Optical Add/Drop Multiplexer (COADM)." (*See* § VIII.E.1(1), above; Bouevitch, Ex. 1003, Abstract; *see also Id.*, 3:9-63, 5:15–20; 14:14-21; Figs. 1, 11.) The "dynamic" portion of this preamble is discussed below for element 17[c]. Bouevitch also describes WDM (wavelength division multiplexing) as the background of the Bouevitch invention, in which the COADM operates to add/drop different wavelengths that are multiplexed together in the input port. (*See* Ex. 1003, 1:18-30, 14:14-15:18; § V.) As for claims 1, 15 and 16, claim 17 is obvious under both Grounds 1 and 2, and Petitioner incorporates by reference its arguments for those claims here to avoid replication.

(1) Element 17[a] – Separating signal into channels

What is identified here as claim 17[a] recites "separating an input multi-wavelength optical signal into spectral channels." Bouevitch discloses this step at

Figure 11, where diffraction grating 20 spatially separates combined channels λ1λ2 ("A" at Fig. 11-Annotation 2, above) into spatially-separated channels. (*See, e.g.*, § VIII.E.1(4) (element 1[c]), above, Bouevitch, annotation "B"; Ex. 1003 at 14:48-53, 8:10–22; McLaughlin Decl., Ex. 1028 at ¶ 112.)

(2) Element 17[b] – Imaging channels

What is identified here as claim 17[b] recites "imaging each of said spectral channels onto a corresponding beam-deflecting element." Claim 21 confirms that one type of such "imaging" is focusing, by reciting "the method of claim 17, wherein said ***imaging comprises focusing*** said spectral channels onto said beam–deflecting elements" (emphasis added). By using the word "comprising" in claim 21, it indicates that imaging is apparently broader than focusing, and thus that imaging at least encompasses focusing. Therefore, art that teaches focusing necessarily discloses the "imaging" of element 17[b], because a species anticipates a claim to a genus. (MPEP §§ 2131.02.)

Bouevitch discloses this imaging step by using reflector 10 in Figure 11-Annotation 3, above, to image (focus) each channel onto a corresponding MEMS mirror element. (*See* § VIII.E.9 (claim 11), Ex. 1003 at Figs. 11, 6a, 15:7-11, 14:14-20, 48-55, Fig. 1, 8:46–49; McLaughlin Decl., Ex. 1028 at ¶ 114.)

(3) Element 17[c] – Dynamic & continuous 2-axis control

What is identified here as claim 17[c] recites: "controlling dynamically and

continuously said beam-deflecting elements in two dimensions so as to combine selected ones of said spectral channels into an output multi-wavelength optical signal and to control the power of the spectral channels combined into said output multi-wavelength optical signal." The only substantive difference between claim 17[c] and claim 1[d] is the addition in 17[c] of "controlling ***dynamically*** and continuously." Thus, other than for "dynamically," the method step of claim 17[c] is disclosed by Bouevitch+Sparks for all the reasons discussed for claim 1[d], above. (*See* § VIII.E.1(5).)

As for "dynamically" controlling the beam-deflecting mirrors, both Bouevitch and Sparks contemplate this manner of control. The plain and ordinary meaning of "dynamically" in context of the '368 Patent is "during operation." (*See* Bouevitch, Ex. 1003 at 3:22-23 (contrasting routing that is fixed during operation: "the [prior art] wavelength routing is intrinsically static, rendering it difficult to dynamically reconfigure these OADMs."); McLaughlin Decl., Ex. 1028 at ¶¶ 116-117.) Both Bouevitch and Sparks teach dynamic control during operation. Bouevitch's device can be used as a "dynamic gain equalizer and/or configurable add/drop multiplexer," which includes dynamic control of the mirrors that perform those actions. (Ex. 1003 at 2:24-25.) Sparks teaches closed-loop 2-axis control (Ex. 1004 at 4:39-47) which the PHOSITA would have understood to mean making adjustments to the deflection of the beam in response to real-time monitoring of the

channel power level. (McLaughlin Decl., Ex. 1028 at ¶ 117.)

15. Claim 18

Claim 18 recites "The method of claim 17, wherein said selected ones of said spectral channels comprises a subset of said spectral channels, such that other non-selected ones of said spectral channels are dropped from said output multi-wavelength optical signal." Claim 18 is substantively identical to a portion of apparatus claim 15, whereby "a subset of said spectral channels is directed to said drop ports," and is disclosed by Bouevitch+Sparks for the same reasons discussed for claim 15. (*See* § VIII.E.12.) Bouevitch is directed to optical add/drop multiplexers involving dropping one subset of channels, adding others, and passing the resulting combination on through an output port. For example, Bouevitch describes selecting a subset of combined channels $\lambda_1\lambda_2$ (i.e., the subset λ_1) to pass through to the output, while the non-selected channel, λ_2, is dropped. (*See, e.g.*, §§ 0, VI(e).) Also, Sparks describes using selectively routing signals between input arrays and output arrays of fibers consistent with add and drop functionality. (Ex. 1004 at 4:33-38 and 59-67; McLaughlin Decl., Ex. 1028 at ¶ 118.)

16. Claim 19

Claim 19 recites "The method of claim 18, wherein said controlling comprises reflecting said non-selected ones of said spectral channels to one or more drop ports." Claim 19 is also substantively identical to a portion of apparatus

claim 15, where the beam-deflecting elements reflect a subset of their corresponding channels to one or more drop ports. Thus, claim 19 is disclosed by Bouevitch+Sparks for the same reasons as for claim 15. For example, if input channel is not selected for retention, it is reflected along a path where it exits the "OUT DROP" port in Bouevitch. (Ex. 1003 at 14:60-65, § VIII.E.12, above.)

17. Claim 20

Claim 20 recites "The method of claim 17 further comprising imaging other spectral channels onto other corresponding beam-deflecting elements, and controlling dynamically and continuously said other beam-deflecting elements so as to combine said other spectral channels with said selected ones of said spectral channels into said output multi-wavelength optical signal." The only limitations this dependent claim adds to the operations recited in parent claim 17 is imaging (focusing) "other channels" to "other beam-deflecting elements" to combine the resulting channels into one output signal.

In addition to the two channels and respective mirrors addressed for claim 17 (§VIII.E.14, above), Bouevitch discloses arbitrarily-sized ROADMS and explicitly discusses embodiments that process additional channels by selectively reflecting them to respective deflecting elements. (McLaughlin Decl., Ex. 1028 at ¶ 121; Bouevitch, Ex. 1003 at 8:8-43 (discussing dropping λ3, while passing through "the other 7 channels having central wavelengths λ1-λ2 and λ4-λ8.")

It was also obvious to perform the add/drop steps of Bouevitch+Sparks on additional spectral channels, as more channels provides additional (and desirable) capacity in a WDM system, and multi-channel systems were known. ('368 Patent , Ex. 1001 at 1:31-42; McLaughlin Decl., Ex. 1028 at ¶ 122.)

18. Claim 21

Claim 21 recites "The method of claim 17, wherein said imaging comprises focusing said spectral channels onto said beam–deflecting elements." Claim 17[b] already recites "imaging each of said spectral channels onto a corresponding beam-deflecting element." And Bouevitch discloses the recited "imaging" by using reflector 10 in Figure 11-Annotation 3, above, to image (focus) each channel onto a corresponding MEMS mirror element. (*See* § VIII.E.14(2), McLaughlin Decl., Ex. 1028 at ¶ 123.)

19. Claim 22

Claim 22 recites "The method of claim 17 further comprising monitoring a power level in one or more of said selected ones of said spectral channels, and controlling an alignment between said input multi-wavelength optical signal and corresponding beam-deflecting elements in response to said monitoring." Claim 22 is similar to claim 3, and is obvious for the same reasons. (*See* § VIII.E.3.) Under either Grounds 1 or 2, Sparks describes the use of a feedback loop to control alignment of the angle of a mirror to control intentional misalignment with an

output port to regulate signal power. (*See, e.g.* Ex. 1004 at 4:29-32 and 46-65, Figs. 1 and 4.) Actuation of the mirror can be responsive to the monitored power of one or more selected spectral channels. (*Id.* at 2:48-65.) The movement of the mirror changes alignment (e.g., angular alignment) between the input path of a beam of the one or more spectral channel and the mirror. (*Id.* at 2:39-47; *see* also id. Fig. 2 showing mirrors 16, 26 moving relative to an input beam from fibre 2; McLaughlin Decl., Ex. 1028 at ¶ 124.)

IX. CONCLUSION

For the foregoing reasons, Petitioner respectfully requests the grans of this Petition and cancellation of claims 1-6, 9-13 and 15-22.

Dated: _February 13, 2015

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.105, I hereby certify that I caused a true and correct copy of the Petition for *Inter Partes* Review in connection with U.S. Patent No. RE42,368 and supporting evidence to be served via FedEx on the following:

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